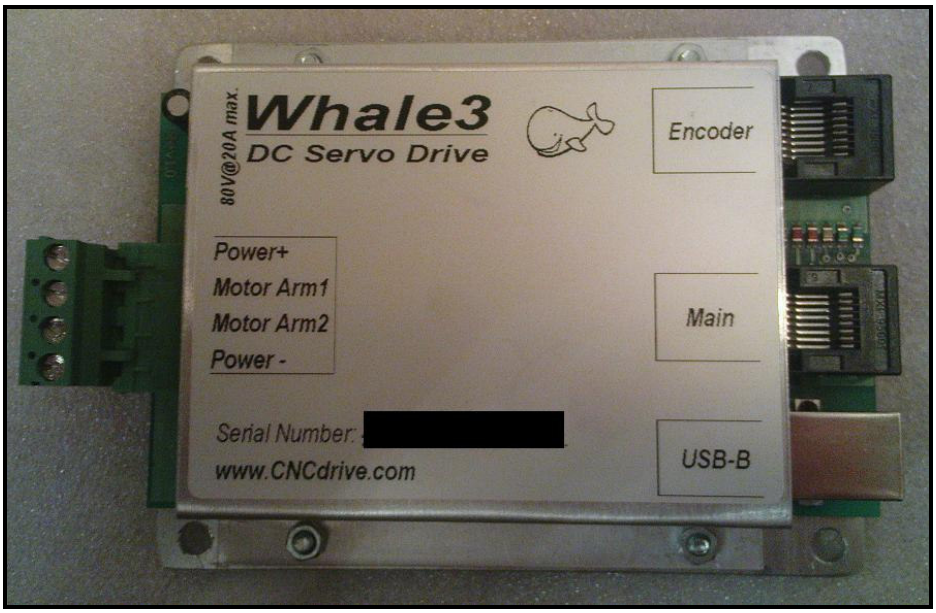
Whale3 servo drive user's manual



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1.1.Safety notes

Please read through this documentation before operating the device.
The device can operate on low and medium DC bus Voltages upto 80VDC. Above 50VDC, the drive's metal case must be connected to safety ground for safety purpose.
Moving objects, like machine axis can be hazardous, avoid touching and keep distance from mechanic moving parts of the machine while the motor power supply is on and connected to the drives.
The device should not be used where it can cause personal injury, death or high financial loss.
Never open the drive's chasis and never touch inner circuity even if it's unpowered.
Take care of power supply's correct polarity connection, wrong polarity connection of the Motor Power supply will cause permament damage to the device.
Never disconnect the motor from the drive when power supply is connected to the drive and is under Voltage.
Do not short the motor output terminals, it may cause permament damage to the device.
The drives are in enclosure, but this metal case is not meant to protect the drive from dust and falling chips, liquid or other moisture material. Please take care to protect the drives from taint damage.

1.2.Policy

CNCdrive cannot take responsibility for any personal injury and/or financial loss caused by their drives' failure or caused by following an error in this documentation.

1.3.Warranty

We give 12 months of standard warranty period with our Whale3 drives. Customers may send back the drives within 15 days from purchase date if they are not safisfied with the performace. Using the drives outside of it's specified electrical ranges may cause permament damage to the device and void warranty. Opening the drive's metal frame and making any modification in it voids warranty.

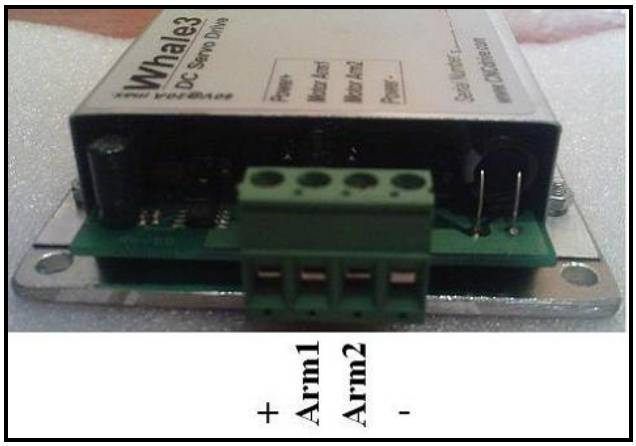
2. Electric specifications and limitations.

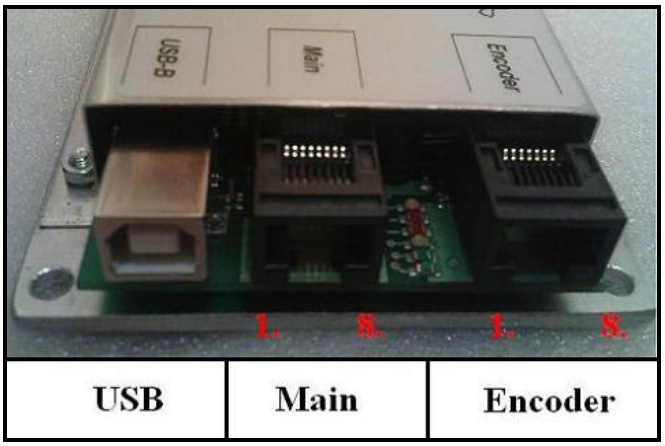
2.1. Operation ranges.

Property	Min	Typ	Max	Unit	Notes
Motor supply voltage	12	-	80	VDC	Optimal U=rated+10..20%
Motor current	0	-	20	A	Limited by drive at set treshold, max. at 20A
Logic supply voltage	9	12	14	VDC	
Logic supply current	100	200	250	mA	
Operating temperature	10		65	°C	Automatic shutdown at 65°C
Opto-isolator input Voltage	3	-	-		Use external series resistor in case of input Voltage>5VDC
Opto-isolator current	3	5	10	mA	
Step input frequency	0		400	kHz	
Direction signal stabile state minimum allowed valid time after step signal active edge	1	1	1	usec	Step signal active and inactive edges can be configured in software by user.
Encoder maximum frequency	1	1	1	MHz	With 4x coding
Switching frequency	20	20	20	kHz	
Maximum continious motor current	20	20	20	Amper	Current is limited at 20A
PID loop sampling time	1		65535	*60usec	User setable in 60usec steps
Minimum allowed motor coil resistance	1.5	1.5	1.5	Ohm	If resistance is lower it should be extended with inductor or with resistor/resistor wire.
Minimum allowed motor coil's inductance	200	-	-	uH	If inductance of the motor coil is lower, it shoud be extended with series coil.

3.1.Connectors.

All connectors in the drive are fast „plug&play” like.





3.1.1.Motor and Motor Power supply connector.

This is a removable plug type 4 pin screw terminal for motor connection (Arm1 and Arm2) and for high Voltage power bus Vdd+ and power GND.

3.1.2.Main connector.

The main connector have the input connections for digital supply input, step and direction signal source connections and restart , stop input connections and error in/output (bidirectional) signal.
The digital supply must be a DC Voltage in a Voltage range specified in Electric Specifications menu point.
This Voltage must be rectified (DC) and smoothed with capacitor. This PSU can be typically a low power universal power supply set to 9 or 12VDC voltage.
Step and direction source signals are feed to the controller through high speed 10Mbit/sec optoisolators(built in drive).
Start and Stop signals are referenced to the digital PSU GND potential, these signals can stop and restart the device.
They are active low signals, which means these lines are pulled up to 5Vdc Voltage inside the drive with weak pull-up resistors. To stop the device operation, pull the stop signal to digital PSU’s GND potential. The drive remains in stopped state until the restart signal is pulled to digital PSU GND potential or the digital PSU is switched off and on again.
Error output signal is also referenced to digital PSU GND potential, under normal operation this line is internally pulled to high state. When an error condition occurs (see Chapter 4.2) this line is pulled low. The line is bidirectional, which means, it can be pulled low by external source to stop the drive and an internal error can also pull

it low. The drive remains in stopped state while the error line is pulled low externally or if an internal error occured it remains stopped until the restart line pulled high or the digital PSU switched off and on again.

Pinout of main connector:

1.) Step signal (input)
2.) Direction signal (Input)
3.) Step/dir source GND
4.) NC (No internal connection)
5.) Restart (Input)
6.) Error (Bidirectional, In/out)
7.) Digital supply + (9..14V DC)
8.) Digital supply -

3.1.3.Encoder interface.

An incremental encoder with differential A,_A and B,_B channels has to be used for position feedback from the motor. A single ended encoder can be also used together with our differential line transmitter circuit(supplied together with the drive).
The encoder must be an incremental and TTL level type with square waves, absolute encoders are not supported.

Pinout of encoder connector:

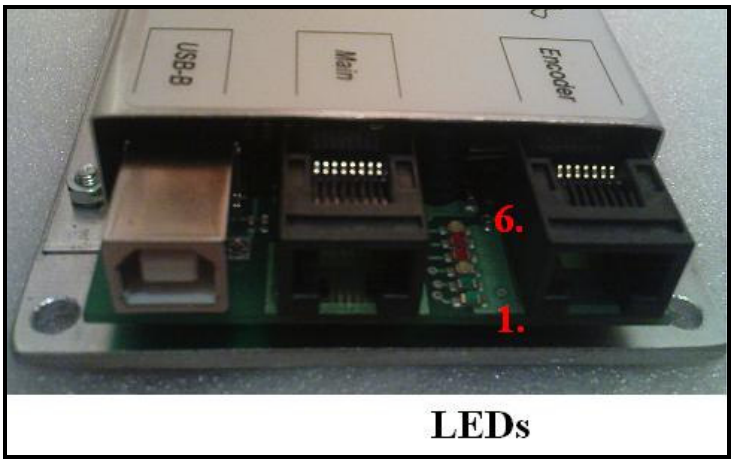
1.) GND
2.) VCC (5V DC, internally generated)
3.) I- (Not used)
4.) I+ (Not used)
5.) A-
6.) A+
7.) B-
8.) B+

3.1.4.USB interface

The USB connection is for configuration purpose. A standard USB A-B cable can be used to connect the drive directly to the USB port of the controller PC. These lines are optically isolated from the device's other parts and from the PC.

4.1.LED indicators

Leds are placed to the board to give feedback from operation.



LEDs

1.) Error limit override LED.
If the servo error signal is greater than the set value in software, the LED will light, indicate this condition
2.) Digital supply indicator LED.
Indicates digital power supply.
3.) Controller running LED.
Indicates normal operation with flashing.
4.) Overcurrent indicator LED.
Indicates current limiting activity.
The LED is lightning when current set treshold reached and current is under limitation.
5.) Motor moving to CW direction.
On when PWM is applied to Arm1.
6.) Motor moving to CCW direction.
On when PWM is applied to Arm2

4.2.Fault conditions

a.)Normal operation
Under normal operation when the digital power supply is connected to the drive, the running LED is blinking with approximately 2Hz frequency.

b.)Overcurrent error condition occurs if the motor has too high power or too low coil resistance or there is a short circuit on the motor output.
Overcurrent is indicated with fast blinking of controller running LED.

c.)Encoder fault error condition occurs if the encoder is not connected to the encoder interface connector or if the encoder is faulty, any of the A,_A,B,_B lines are shorted to GND or 5V or to eachother.
Encoder fault is indicated with blinking of error limit override LED.

d.)Overheating error condition occurs if drive's aluminium backplate's temperature reaches 65°C.

All error conditions also indicated with low pulled error output line in the main connector.

5.1.Installation of drive, mechanic frame.

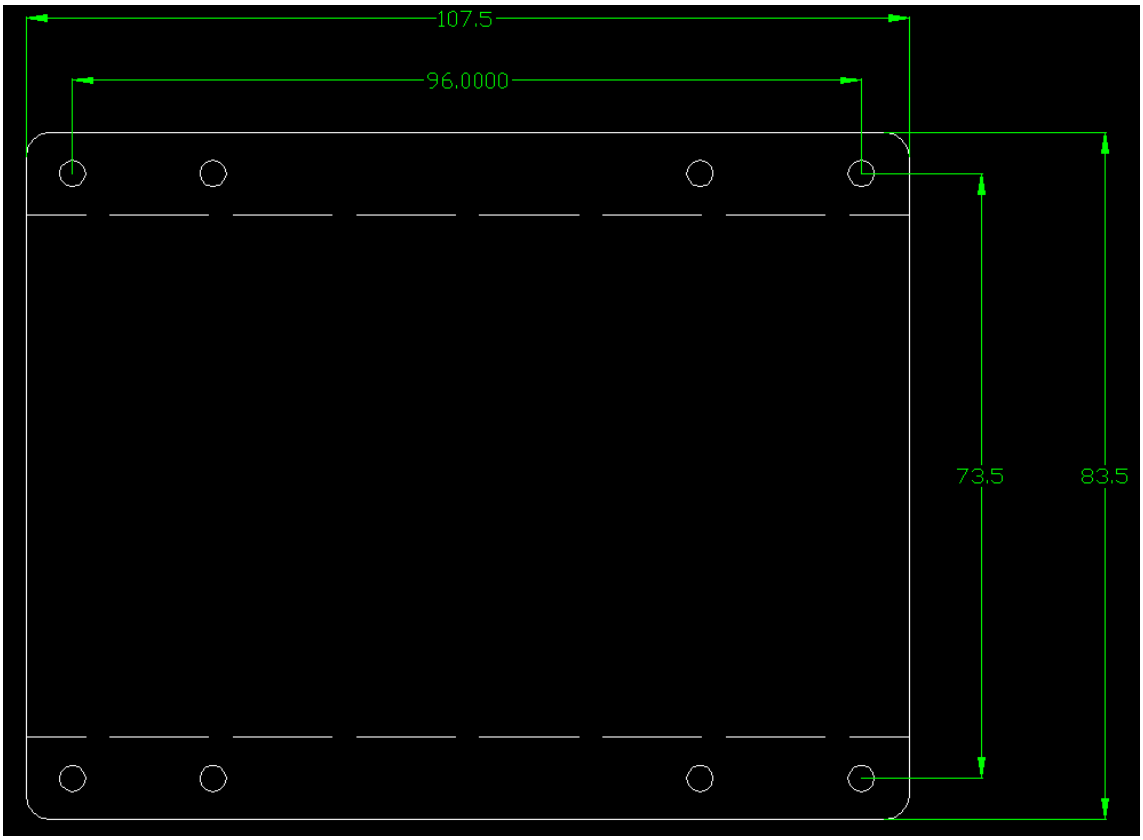


Figure: Drive's backplate dimensions with mounting holes
All dimensions in mm.
Mounting holes diameter = 3.5mm

The drive has 4pcs of 4mm in diameter mounting holes on it's packplate.
The metal case can become hot under heavy current operation and is acting as a cooling rib. It is recommended to place the drive to an external metal frame/cooling rib to make cooling and power dissipation of the device better.
Use cooling paste or silicon plate to get the best termal connection between the drive's metal backplate and external mounting metal frame.

5.2.Motor wiring.

If possible use twisted pair of wires to connect motors to the drives to minimise radiated EMI from the wires. Use as high diameter wires as possible to minimise wire resistance.

5.3.Encoder wiring

Connect patch cable into the encoder terminal for the encoder.
The cable length must be between 1 meters to 100 meters.
Do not use shorter cable than 1m if possible, because in this case cable impedance may not meet the cable driver circuit's requirements.
Do not use a common cable for motor and encoder.

5.4.Shilding technics in general.

The drive has isolated motor power supply and digital power supply. This means the digital power supply ground and motor power supply's ground are floating to eachother to avoid ground loops and therefor noise problems in communication.
Do not use a common Voltage source/transformer for motor and digital power supply. Use separated PSUs and do not connect the two GND points together, keep them separated.

Use shielded cables for the main connector and encoder connector if possible. Connect the encoder and main connector shields to safety GND potential on one end only.

6.Power supply selection and filtering.

The drive needs 2 power supplies for operation, one to feed the digital circuit and one to feed the motor. The digital power supply can be tipically a low power 12VDC Voltage source with rectification an smoothing.
The motor supply should be a power transformer with continious current capability at least of motor's rated continious current rating. It is recommended to use at least 1000uF/Amp smoothing capacitor in the motor PSU after rectifying.
Connect motor PSU with parallel wires to each drive when connecting multiply drives to a common motor PSU, do not wire the drives up in series.
Under high Voltage and/or high current operation it may be nessesary to connect a capacitor >=470uF directly into the motor power supply connector of the drive if wires from PSU to drive are longer than 30cm.
If possible, do not use switching mode powersupplies as motor PSU or if you do, place power resistor-capacitor network onto the output of the SMPS, otherwise the switching powersupply may destroy the drive and/or the drive may destroy the SMPS!

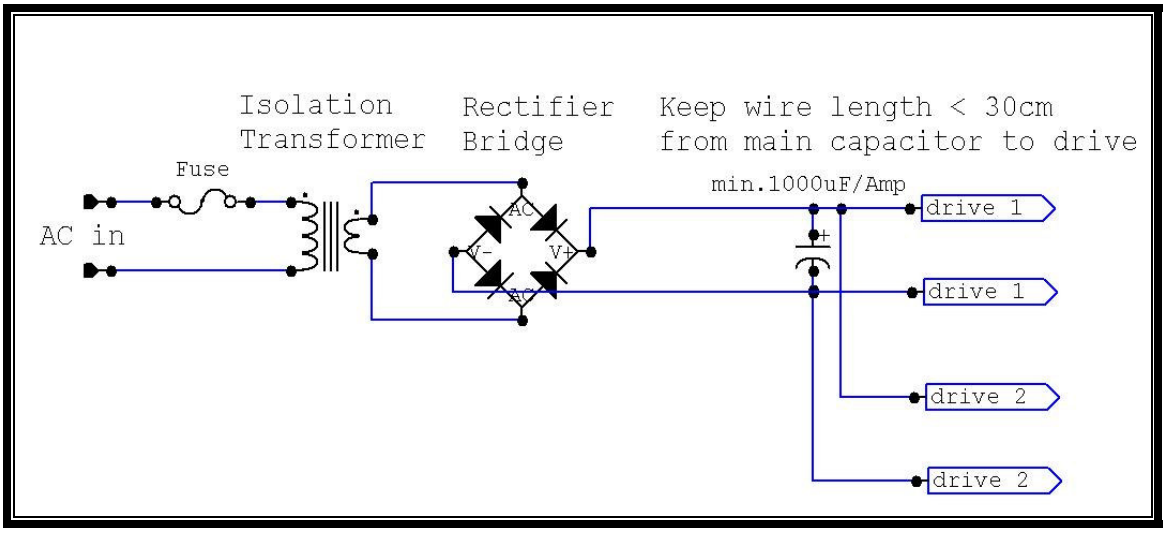


Figure: Ideal basic motor power supply configuration

7.Troubleshooting.

Q:When powering up the drive, the motor runs with full speed to one direction and stops after a while with error-limit reached LED on.

A:Encoder is wired up in reverse, exchange motor Arm1 with Arm2 to reverse direction of the motor.

Q:The motor is oscillationg over the nullpoint when powerup.

A:Tune the PID controller with the Servoconfigurator3 software.

Q:I like to control my motor with a PLC which has 24V I/Os, is it possible?

A:The step and direction pins are feed through optoisolators. Use a series resistor with the step and with the direction signal from the PLC.
Resistor must be sized so that the opto-isolator current must be limited under 10mA.

Q:I like to control an AC servomotor with the drive, is it possible?

A:No. The drive can only control brush type DC servomotors.

Q:I have a disk-type servomotor with coil resistance of lower than 1.5 Ohms and an inductance of lower than 200uH, what to do?

A:Use a resistor wire and/or inductor in series with the motor coil to extend resistance to at least 1.5 Ohm and inductance to at least 200uH otherwise the motor and/or drive may damage.

Q:I have a motor that have a rated Voltage greater than 80VDC, can I used it with the drive.

A:Yes, but do not connect a PSU with an overvoltage, absolute maximum motor Voltage ratings of the drive is 80VDC. If your motor has higher Voltage, it will operate from 80VDC, but with limited maximum torque. The best way is to use a higher Voltage rated drive in this case.

For more information visit:

http://www.cncdrive.com

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